Using sustainability concepts to reduce risk

Paul Linden

Department of Mechanical & Aerospace Engineering
Environment and Sustainability Initiative
UC San Diego

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IPCC Working Group 1
Summary for Policymakers (2 Feb. 2007)

-
- **Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.**

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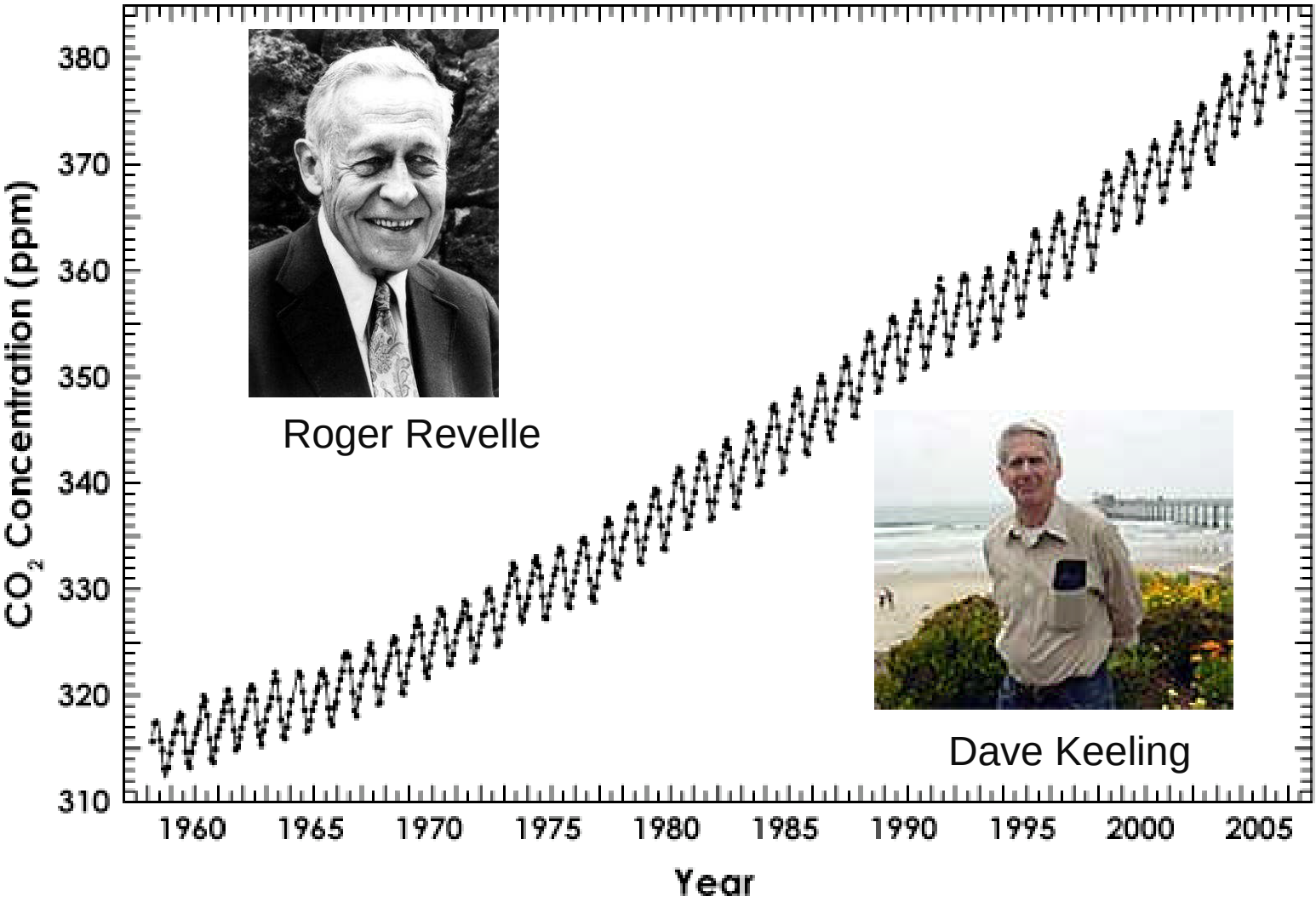
Mauna Loa Record

Roger Revelle

Dave Keeling



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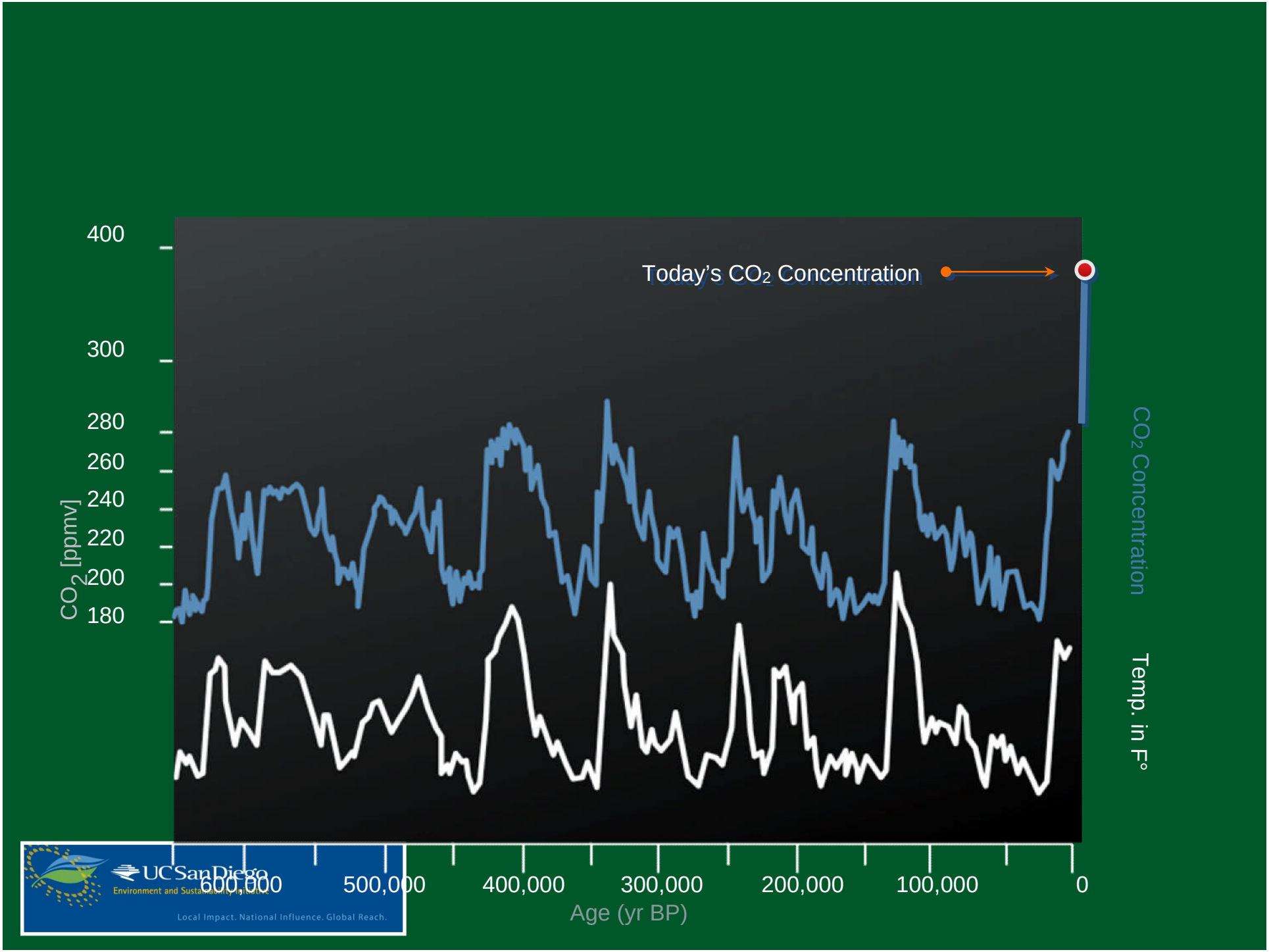
Today's CO_2 Concentration
400
300
280
260
240
220
200
180
CO_2 [ppmv]
CO_2 Concentration
Temp. in F°
600,000
500,000
400,000
300,000
200,000
100,000
0
Age (yr BP)
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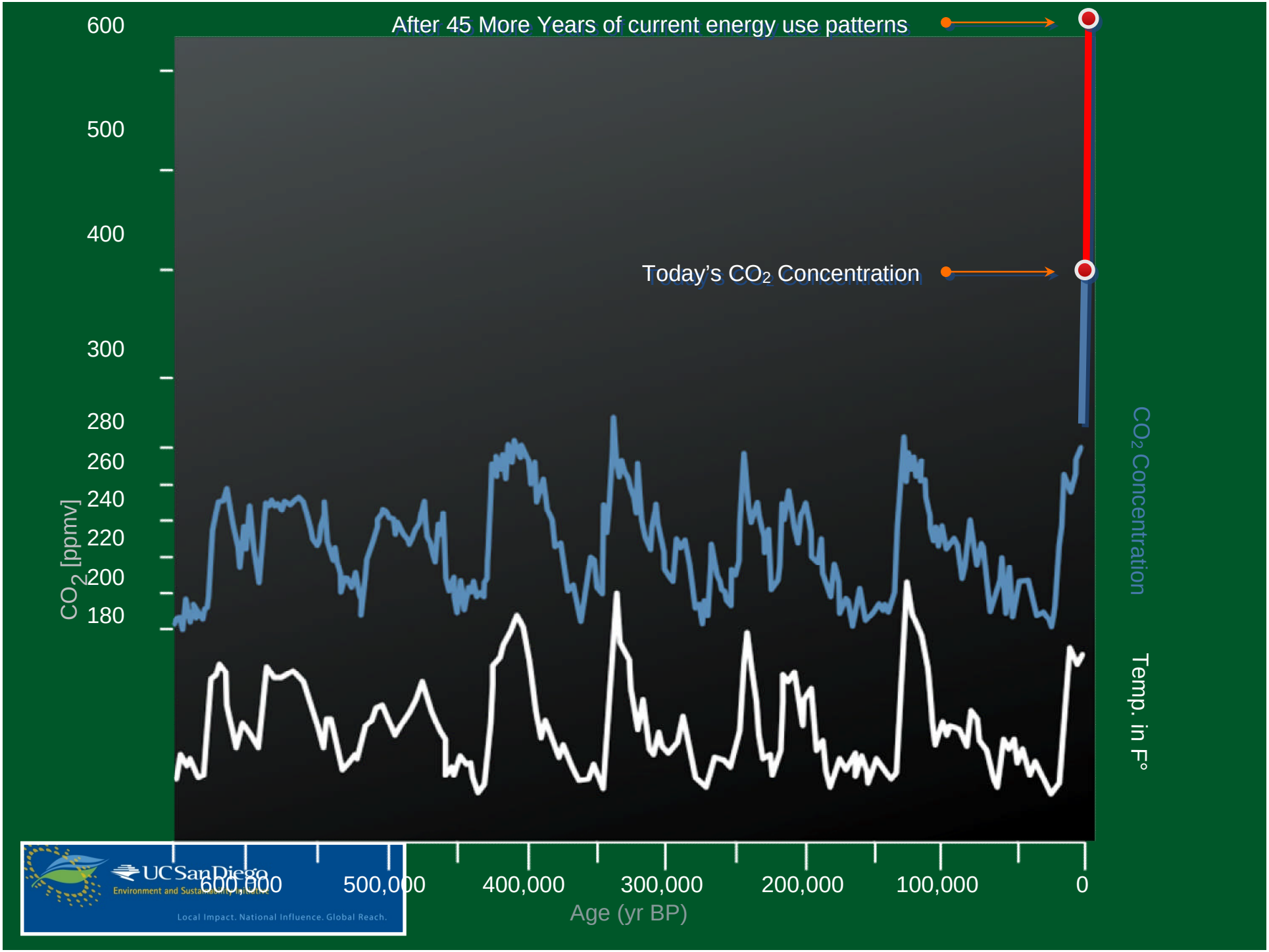
After 45 More Years of current energy use patterns
Today's CO_2 Concentration
600
500
400
300
280
260
240
220
200
180
CO_2 [ppmv]
CO_2 Concentration
Temp. in F°
600,000
500,000
400,000
300,000
200,000
100,000
0
Age (yr BP)
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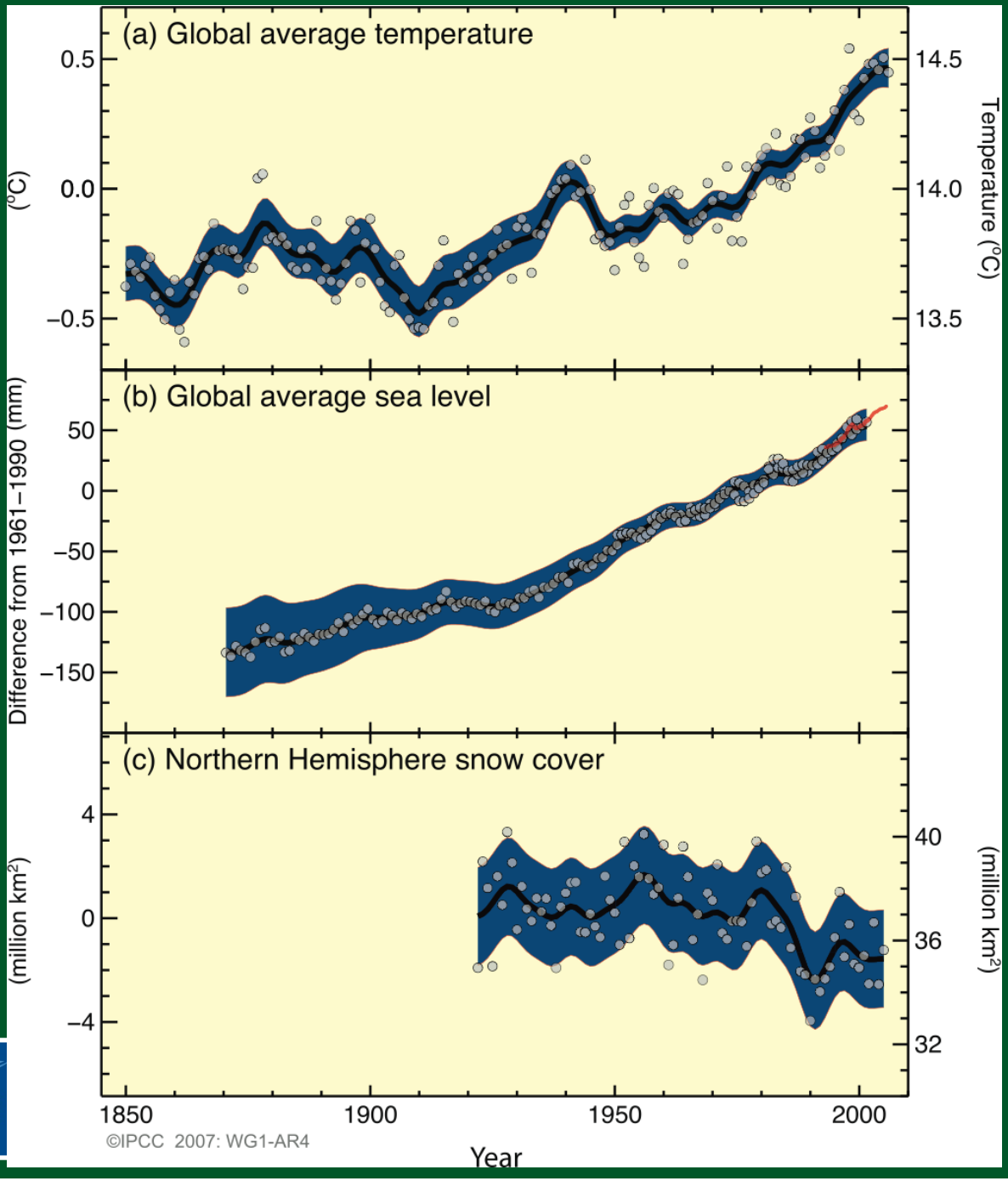
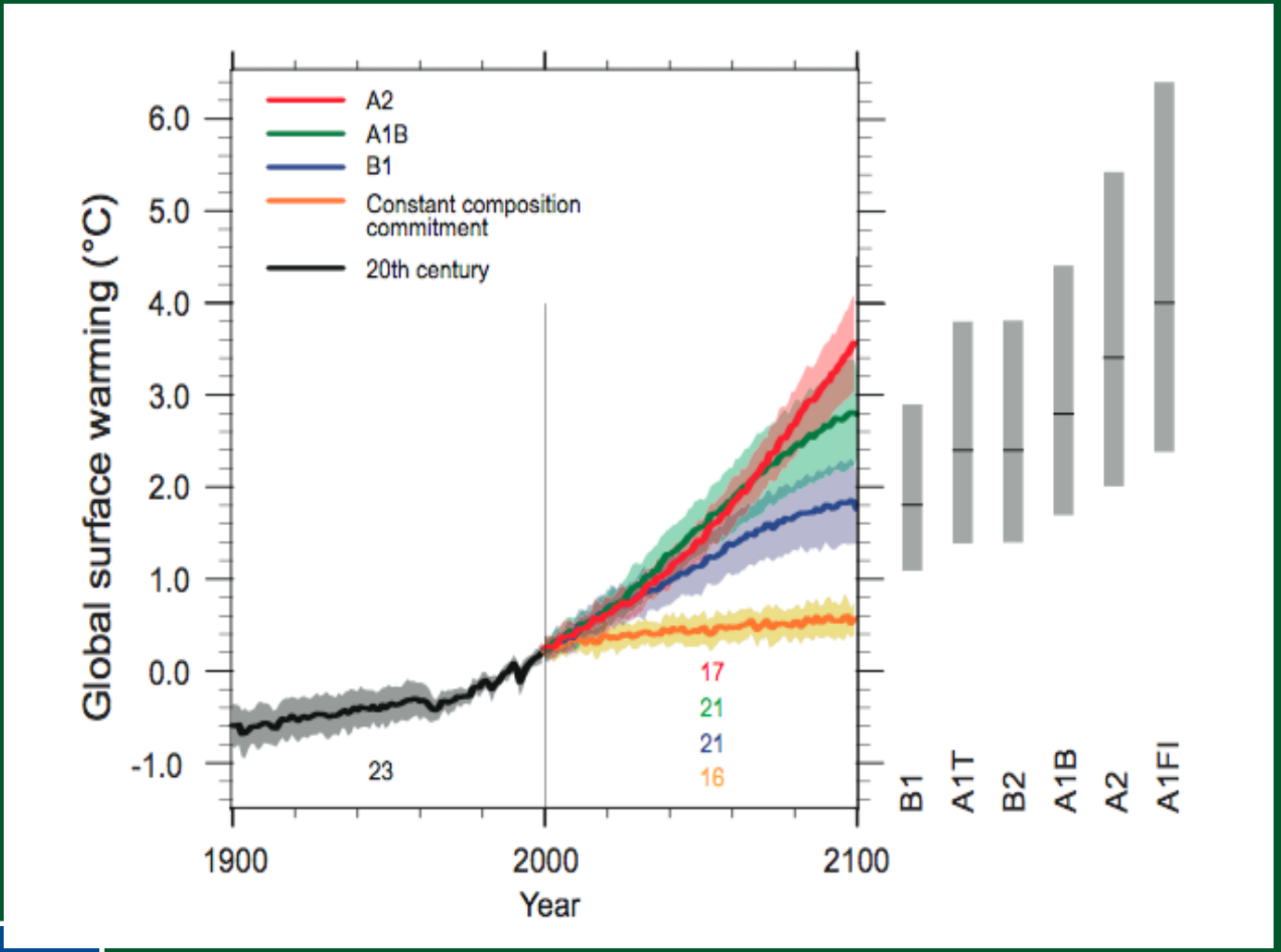


The science is clear.

The climate is changing.

Projections of Future Changes in Climate

Best estimate for low scenario (B1) is 1.8°C (*likely* range is 1.1°C to 2.9°C), and for high scenario (A1FI) is 4.0°C (*likely* range is 2.4°C to 6.4°C).



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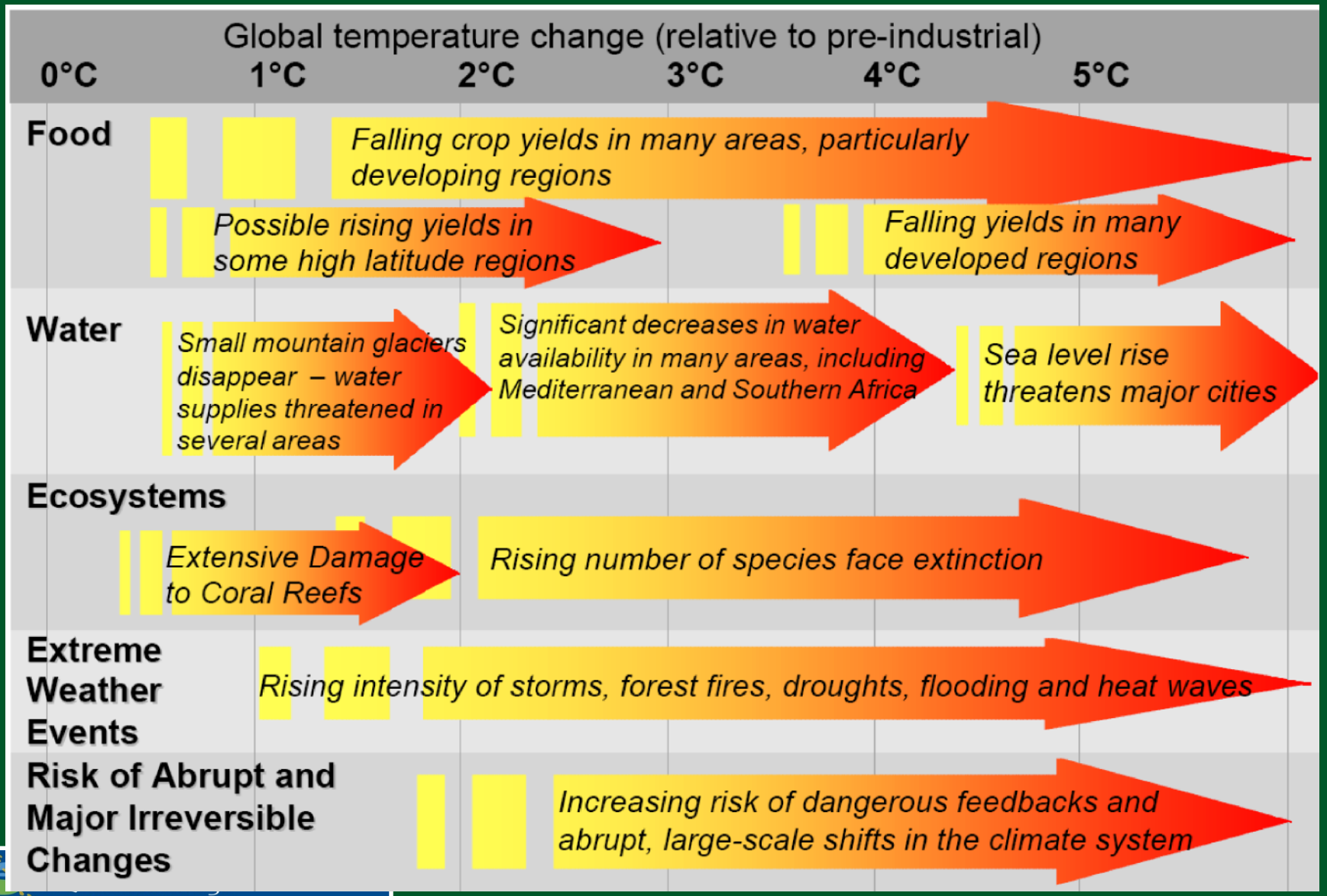
Consequences of Climate Change



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SSource: Stern Review: The Economics of Climate Change


FIRE

Banda Aceh

Banda Aceh

Banda Aceh

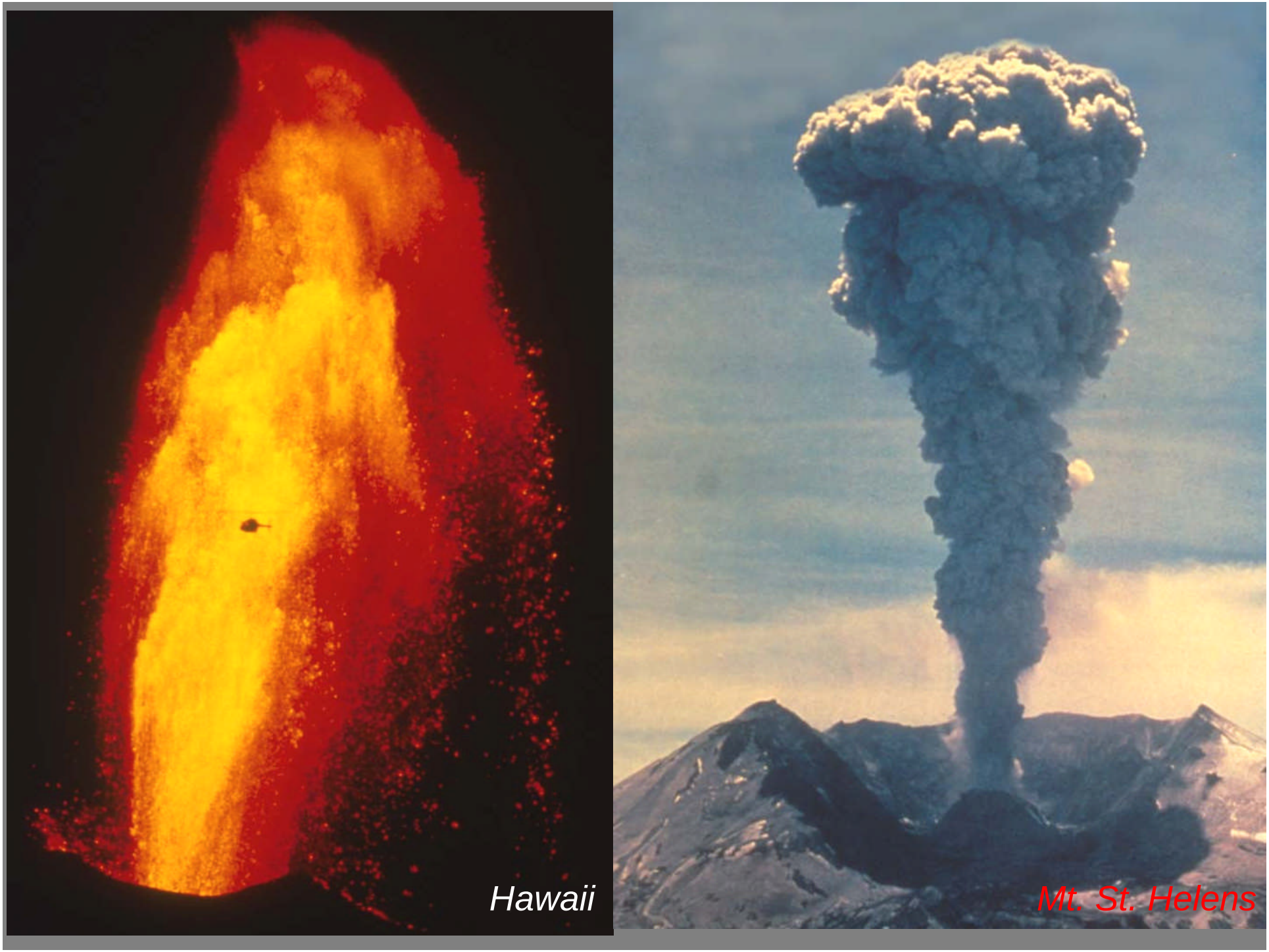
Jamie Wiseman, Daily Mail

… after a terrible earthquake … the sea flowed out a long way, and ships were left stranded on dry land. When many people came running out to see this extraordinary wonder, the sea flowed back beyond its accustomed limits, and 50,000 people were drowned.

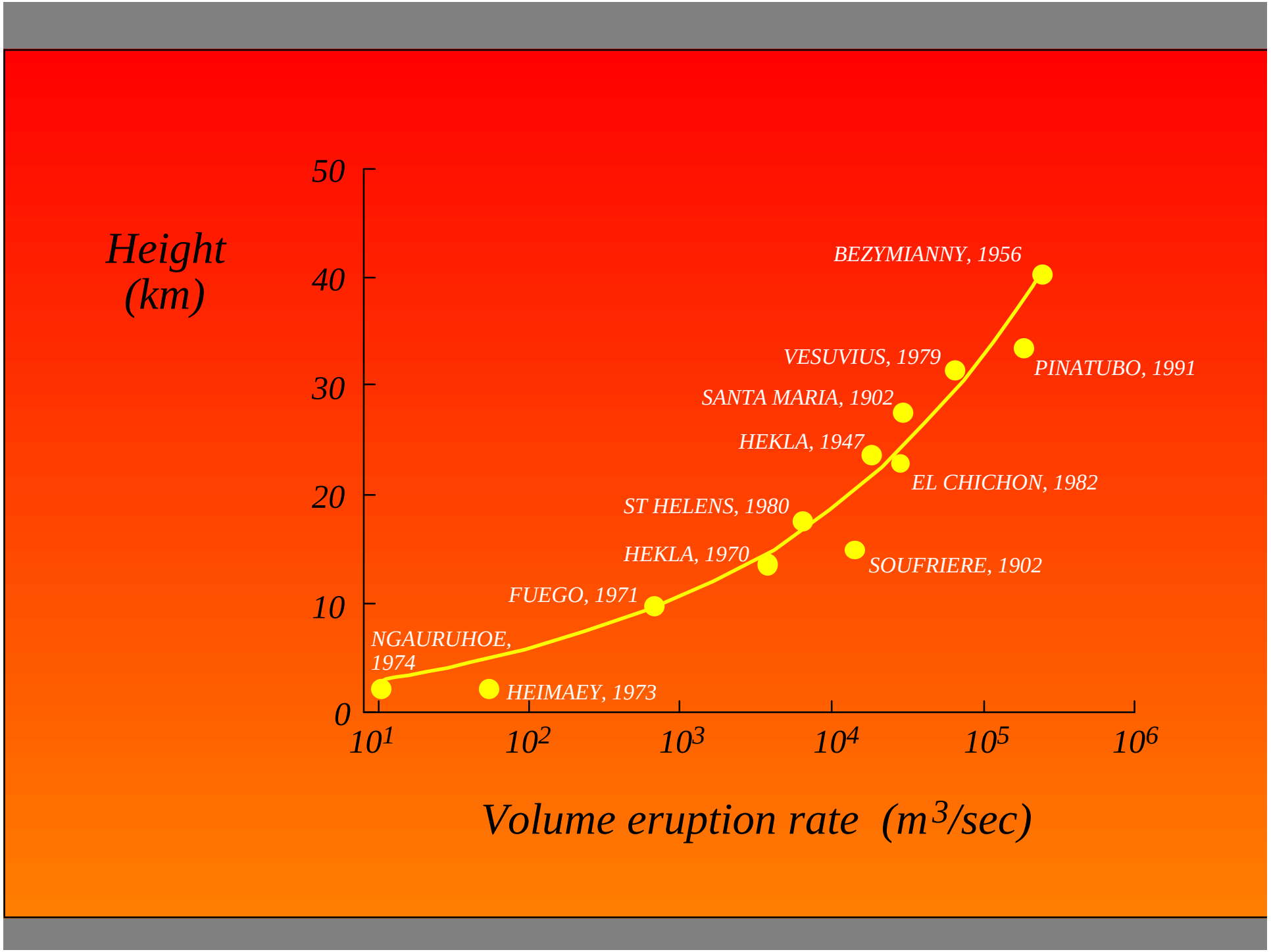
Alexandria, Egypt 365 AD

Volcanoes

Mount Hood, Oregon

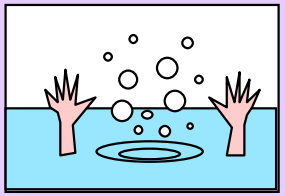

Hawaii
Mt. St. Helens

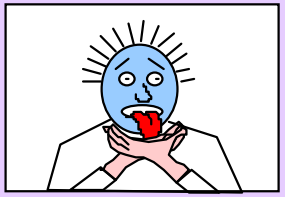
Mount Redoubt,

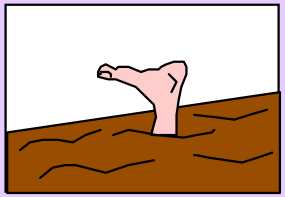

Height (km)
50
40
30
20
10
0
BEZYMIANNY, 1956
VESUVIUS, 1979
PINATUBO, 1991
SANTA MARIA, 1902
HEKLA, 1947
EL CHICHON, 1982
ST HELENS, 1980
HEKLA, 1970
SOUFRIERE, 1902
FUEGO, 1971
NGAURUHOE, 1974
HEIMAEY, 1973
10^1
10^2
10^3
10^4
10^5
10^6
Volume eruption rate (m^3/sec)

Deaths due to Volcanic Eruptions

Year	Volcano	Number	Main cause
1883	Krakatoa (Java)	35 000	Drowning
1902	Mont Pelee (West Indies)	29 000	Asphyxiation
1985	Nevado del Ruiz (Columbia)	22 000	Mud slides
1600 to present		260 000	

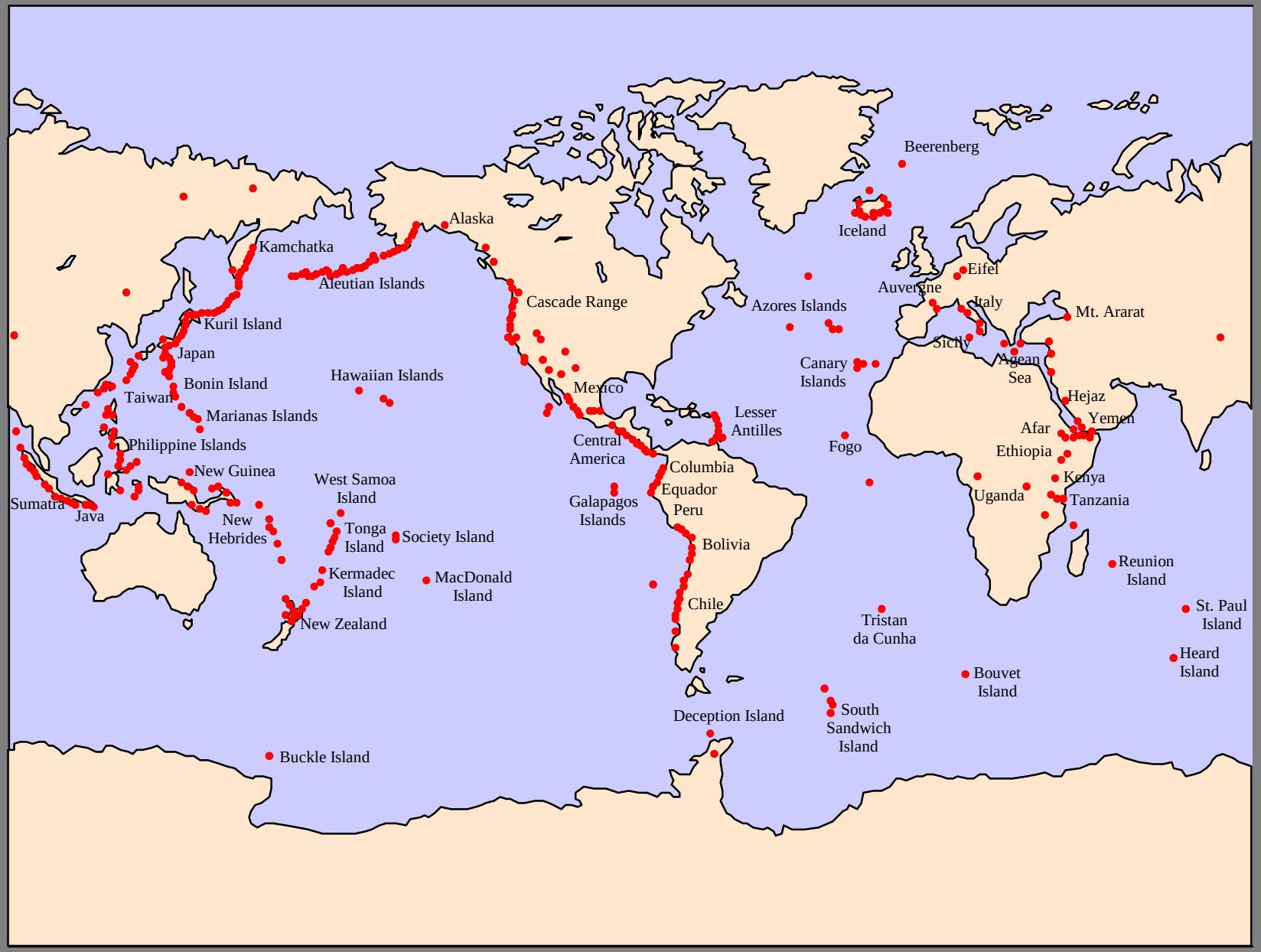






1900 to present: $10 000 000 000 property damage

Worldwide Volcanic Activity



The locations of volcanoes which erupted during the past 12,000 years.

Earthquakes

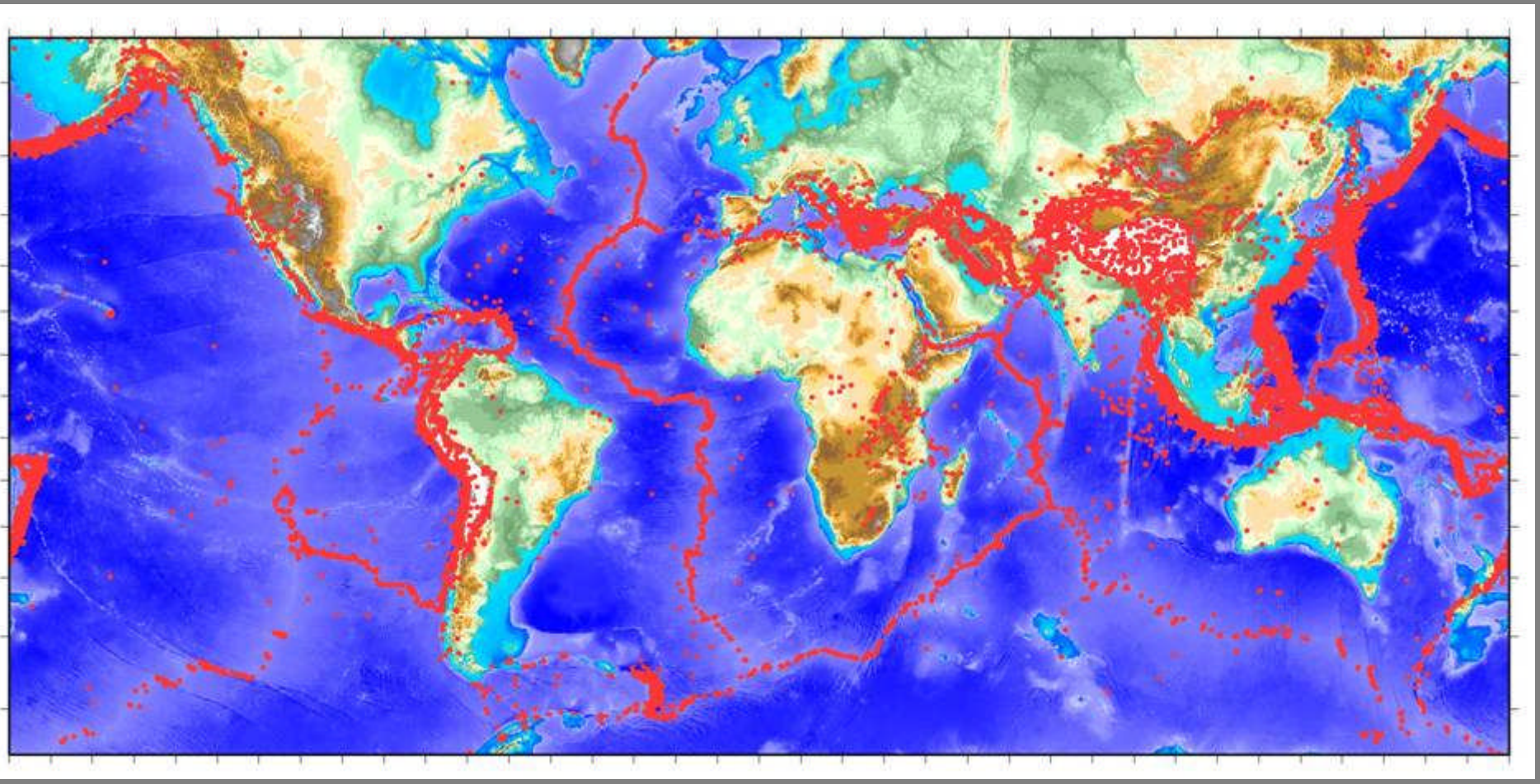
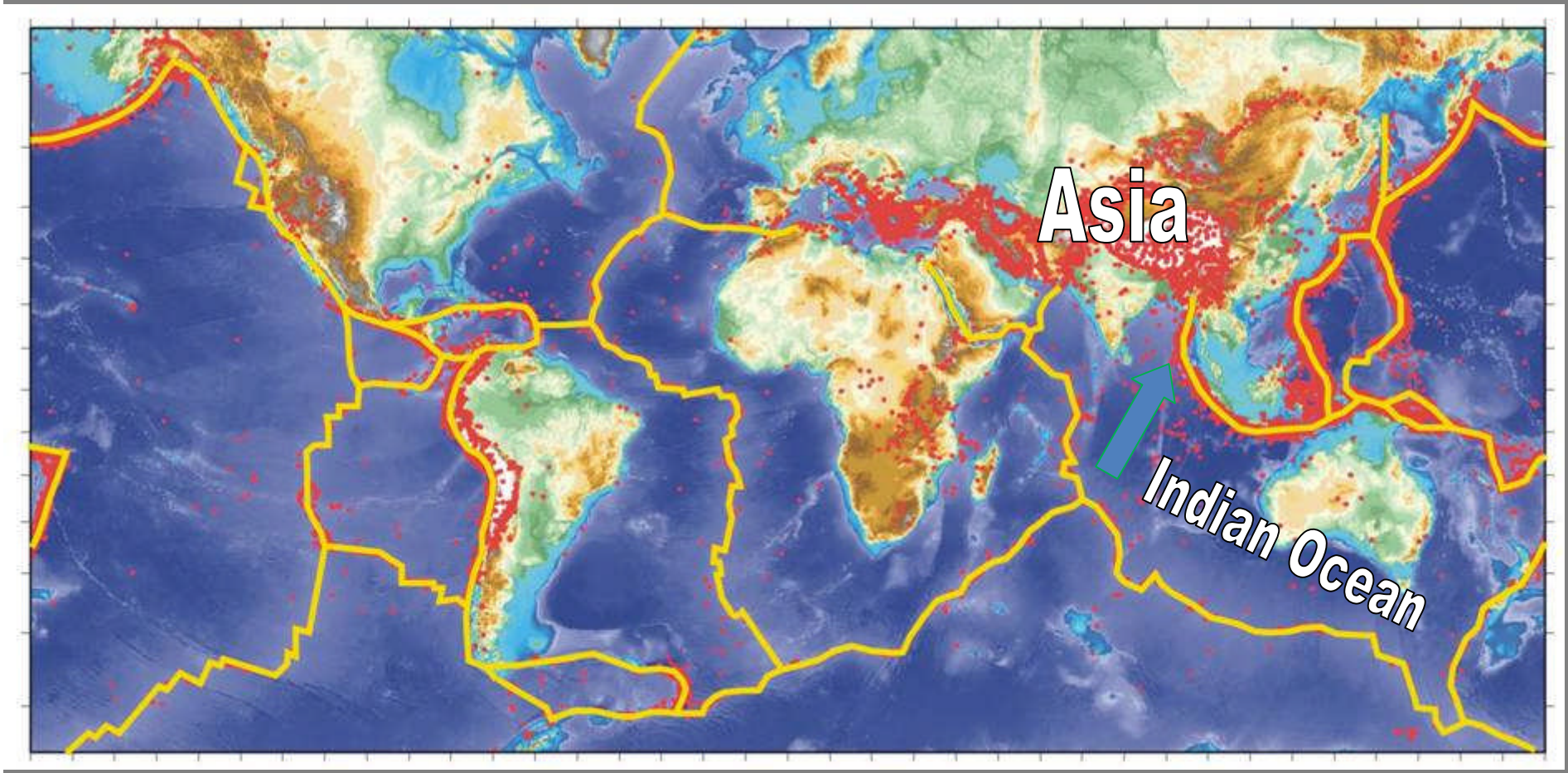
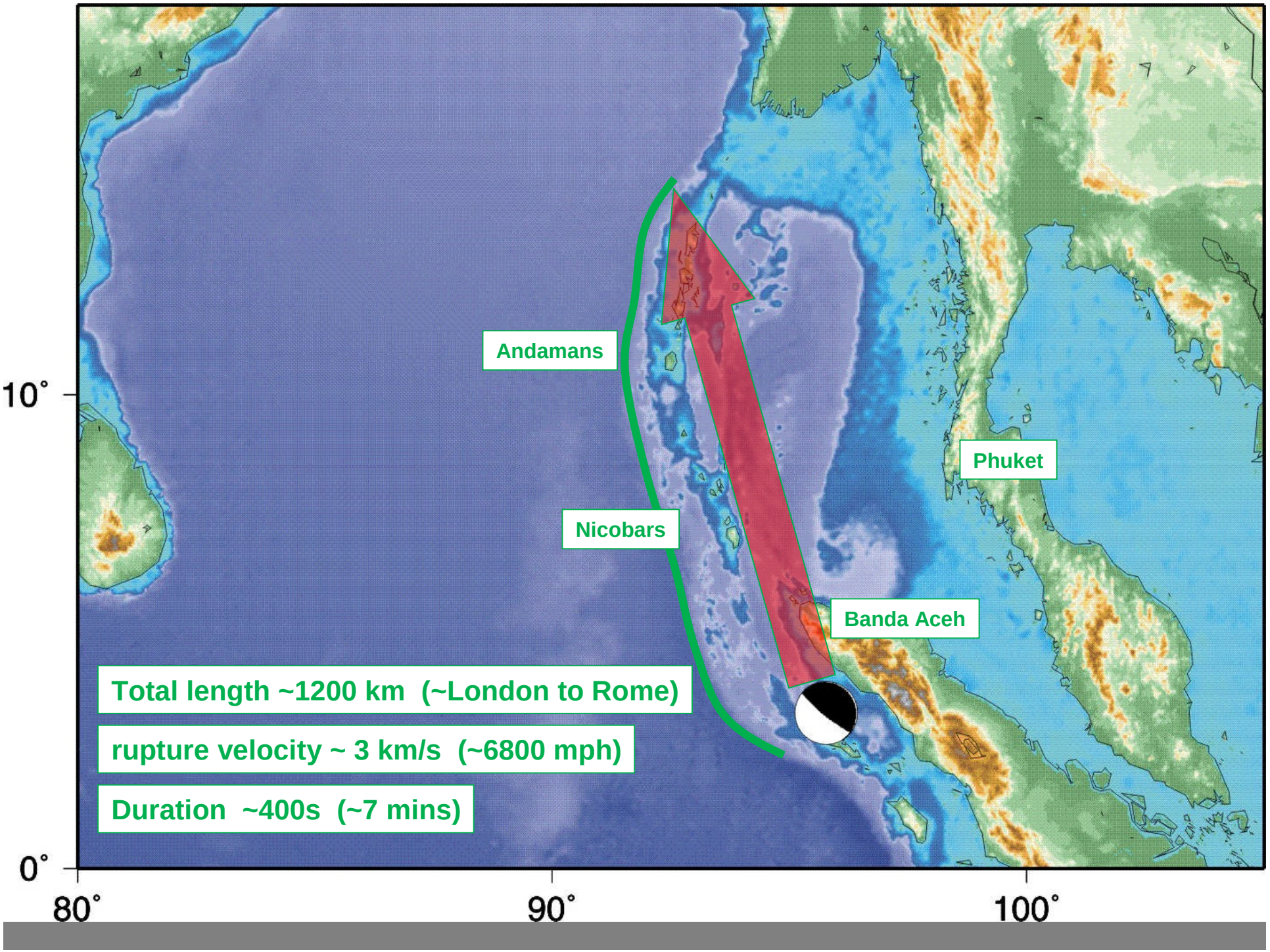
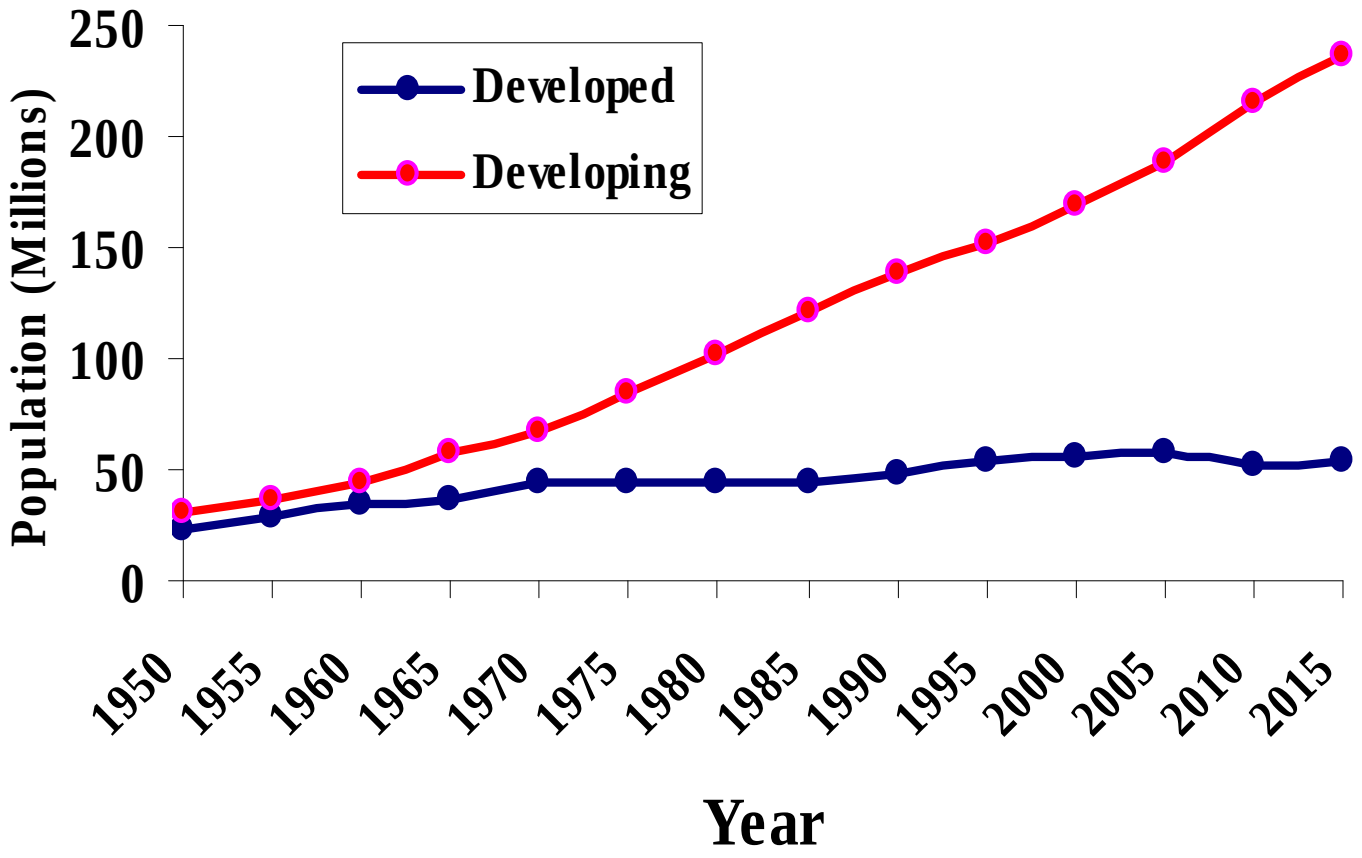


Plate boundaries

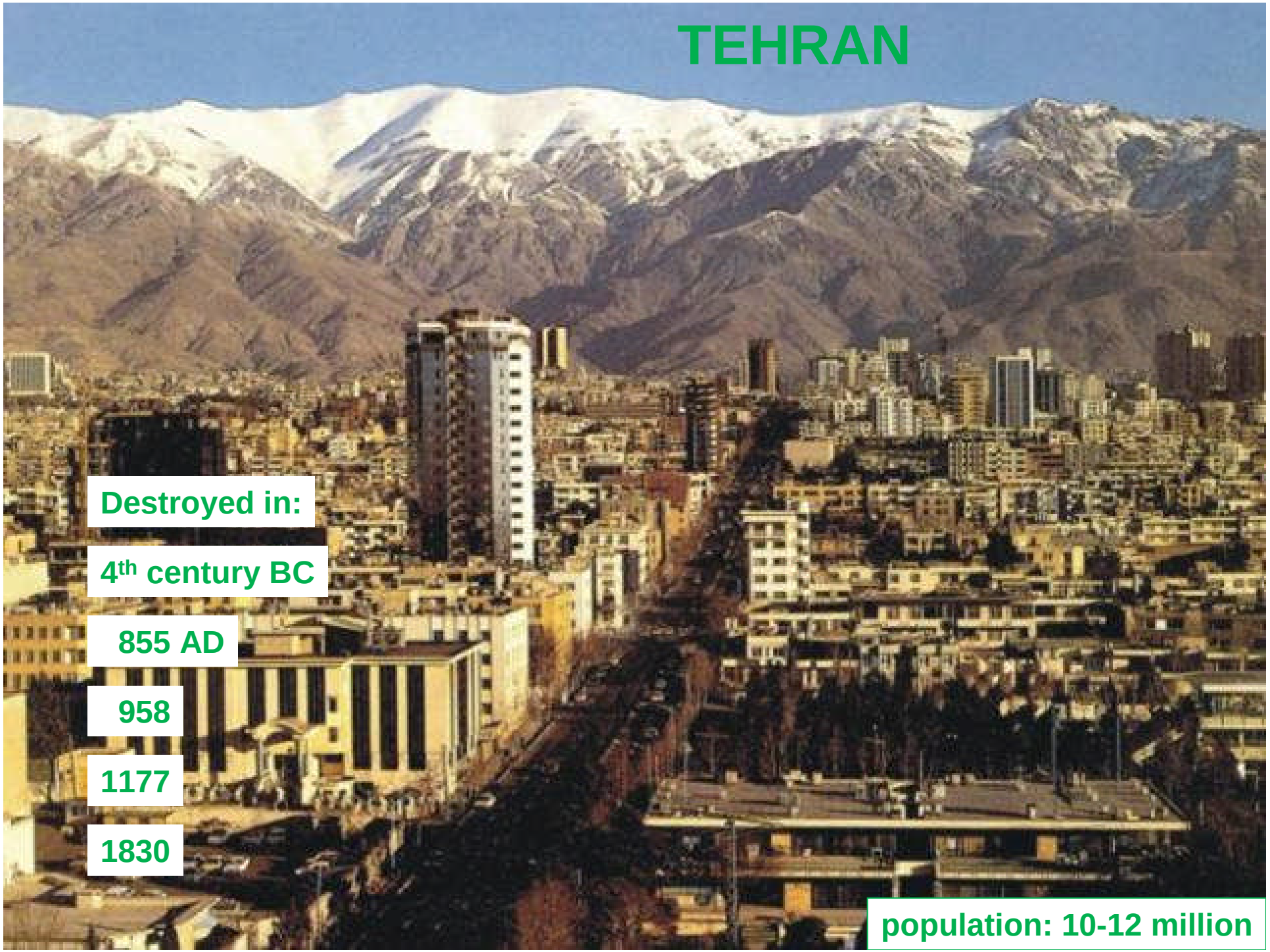



Andamans
Nicobars
Phuket
Banda Aceh
Total length ~1200 km (~London to Rome)
rupture velocity ~ 3 km/s (~6800 mph)
Duration ~400s (~7 mins)
10°
0°
80°
90°
100°

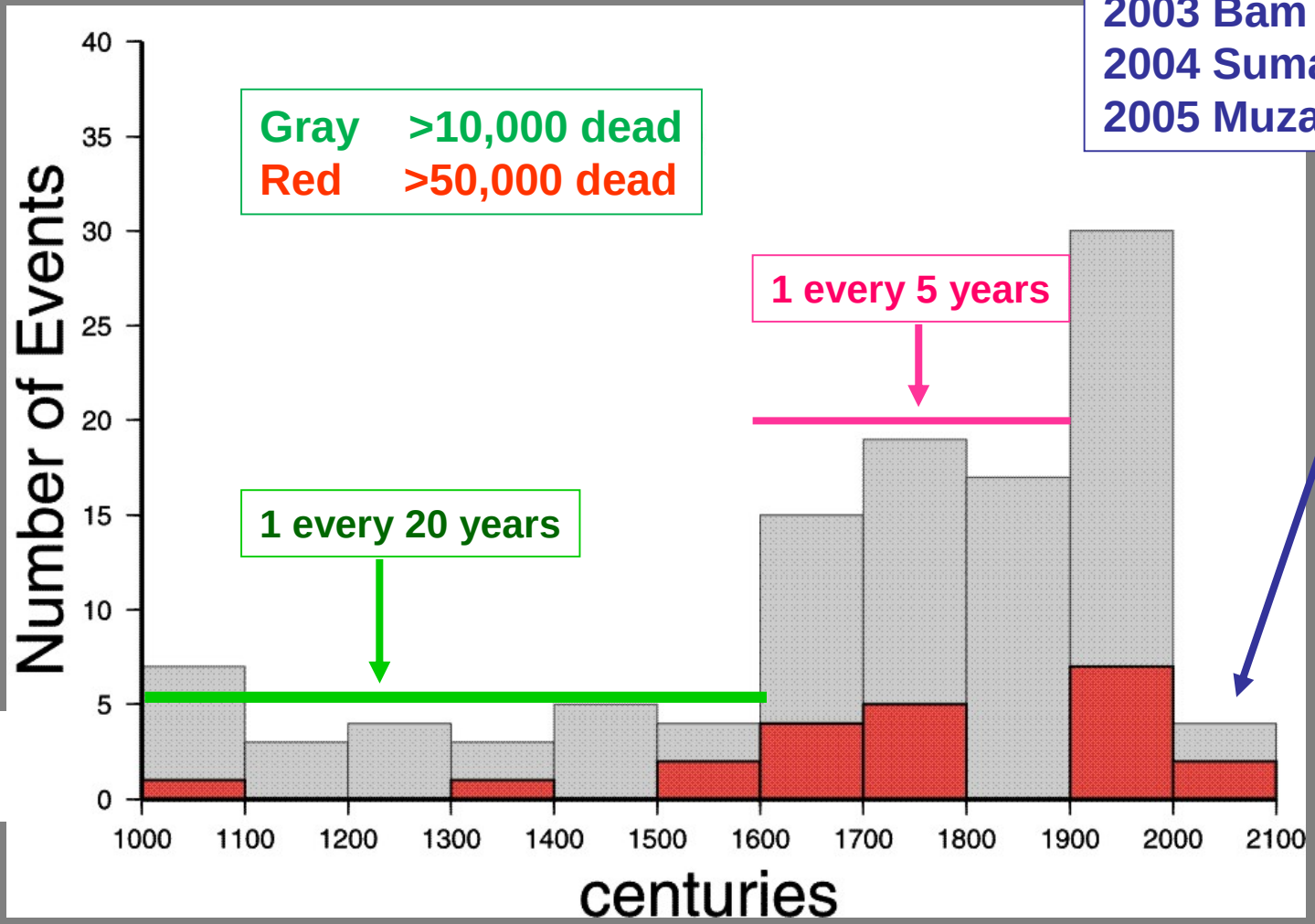
Population of 20 Largest At-Risk Cities




Tabas-e-Golshan 1978 (M_w 7.3)
13,000 population
11,000 dead


TEHRAN
Destroyed in:
4th century BC
855 AD
958
1177
1830
population: 10-12 million

	dead
2001 Bhuj	19,000
2003 Bam	40,000
2004 Sumatra	>200,000
2005 Muzaffrabad	73,000



Earthquakes that killed more than 10,000 people

1989	Loma Prieta, California	M 7.1	64 dead
1994	Northridge, California	M 6.8	50 dead
2003	Bam, Iran	M 6.8	40,000 dead

USC Hospital, California

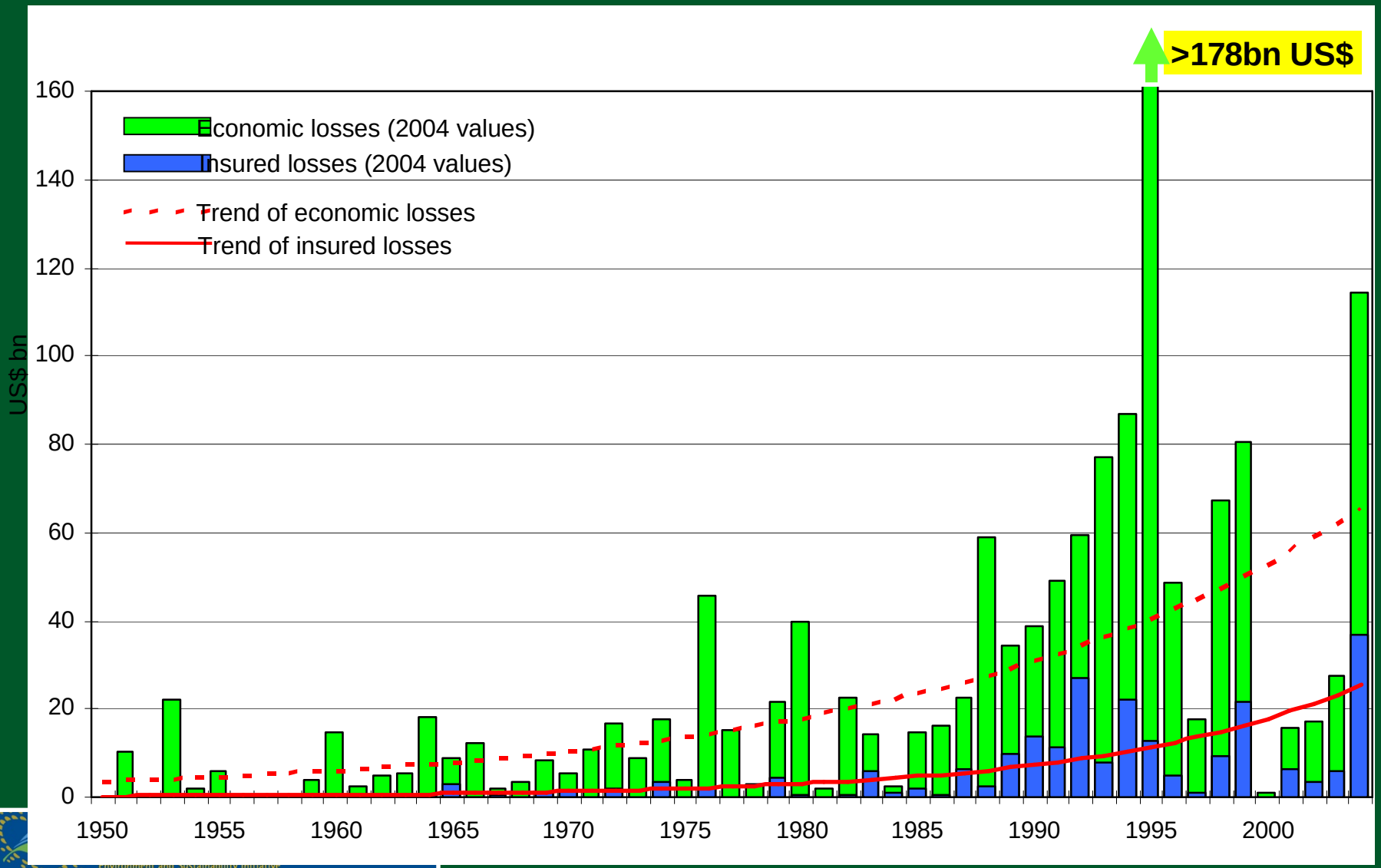
Bam, Iran

not one test-tube lost…

The 12 most costly insurance losses 1970 - 2006

INSURED LOSS (in USD m, indexed to 2006)	**VICTIMS**	**DATE**	**EVENT**	**COUNTRY**
66,000	1836	2005	Hurricane Katrina	US
23,000	43	1992	Hurricane Andrew	US, Bahamas
21,000	3000	2001	Terror attack on 9/11	US
19,000	61	1994	Northridge earthquake (M 6.6)	US
14,000	124	2004	Hurricane Ivan	US, Caribbean
13,000	35	2005	Hurricane Wilma	US, Mexico, Jamaica, Haiti et al.
10,000	34	2005	Hurricane Rita	US, Gulf of Mexico, Cuba
9,000	24	2004	Hurricane Charley	US, Cuba, Jamaica et al.
8,000	51	1991	Typhoon Mireille	Japan
7,000	71	1989	Hurricane Hugo	US, Puerto Rico et al.
7,000	95	1990	Winter storm Daria	France, UK, Belgium, NL et al.
7,000	110	1999	Winter storm Lothar	Switzerland, UK, France et al.

Great Natural Disasters 1950 – 2004
Economic and insured losses



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12 Worst catastrophes for victims 1970 -- 2006

VICTIMS	DATE	EVENT	COUNTRY
300,000	1970	Storm and flood	Bangladesh
260,000	1976	Earthquake (M 7.5)	China
220,000	2004	Earthquake (M 9), tsunami in Indian Ocean	Indonesia, Thailand et al.
140,000	1991	Tropical cyclone Gorky	Bangladesh
73,000	2005	Earthquake (M 7.6); aftershocks, landslides	Pakistan, India et al.
66,000	1970	Earthquake (M 7.7); rock slides	Peru
40,000	1990	Earthquake (M 7.7); landslides	Iran
35,000	2003	Heat wave and drought in Europe	France, Italy, Germany et al.
26,000	2003	Earthquake (M 6.5) destroys 85% of Bam	Iran
25,000	1988	Earthquake (M 6.9)	Armenia, ex-USSR
25,000	1978	Earthquake (M 7.7) in Tabas	Iran
23,000	1985	Volcanic eruption on Nevado del Ruiz	Colombia

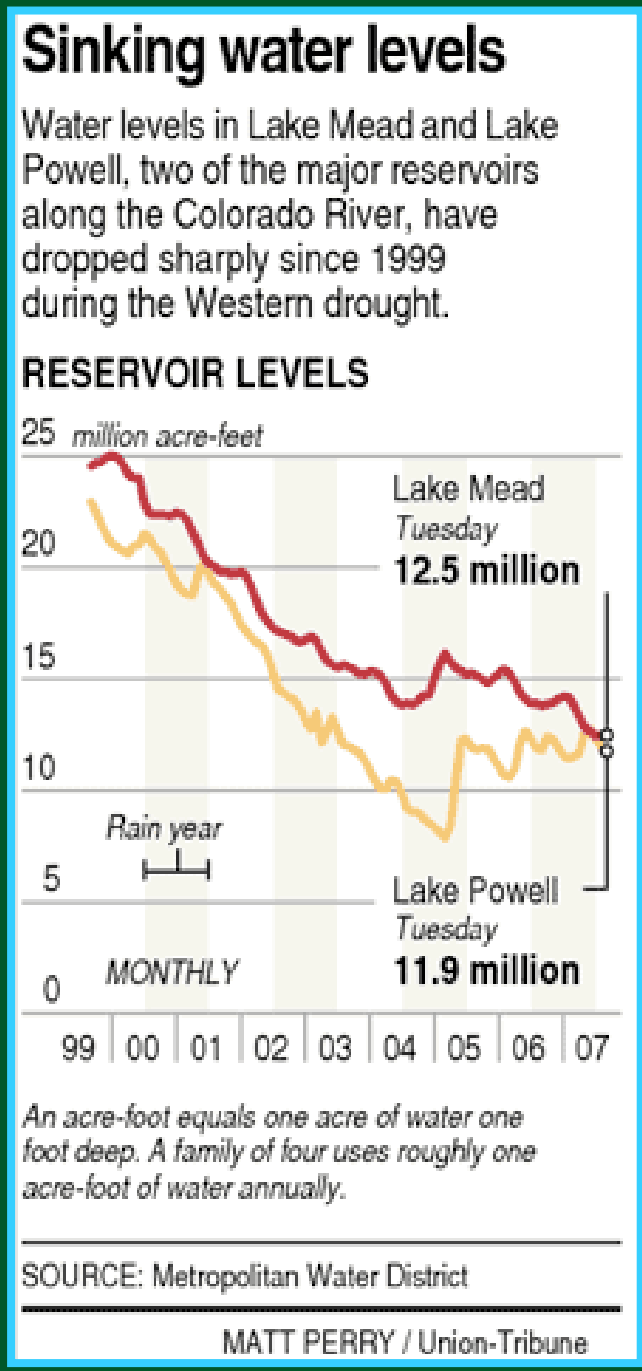
•What does it mean for San Diego?

Vanishing ice worries West

Accelerating Arctic melting could change weather patterns in region, bring less rain

UNION-TRIBUNE, September 27, 2007

Witch Creek Fires, Oct. 23, 2007



•Lake Mead Could Be Dry by 2021

There is a 50 percent chance Lake Mead, a key source of water for millions of people in the southwestern United States, will be dry by 2021 if climate changes as expected and future water usage is not curtailed.

Without Lake Mead and neighboring Lake Powell, the Colorado River system has no buffer to sustain the population of the Southwest through an unusually dry year, or worse, a sustained drought. In such an event, water deliveries would become highly unstable and variable...

UCSD as a Living Laboratory

- Community of 40,000 people
- All aspects of urban life – housing, offices, retail, production, laboratories, medical, dining, medical, sports, transportation, open spaces
- Experiments and research are a way of life
- Exposes students to sustainability

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Why GREEN Buildings

Buildings are responsible for

- 65% of US Electricity use

- 30% of US Greenhouse Gas emissions.

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Research: MAE on low-energy buildings

UCSD Projects - Photovoltaics

- 1MW installed in 2008
- 2.4 MW planned for 2009

Research: ECE and MAE on

- PV efficiency
- New materials
- Nanoscale devices

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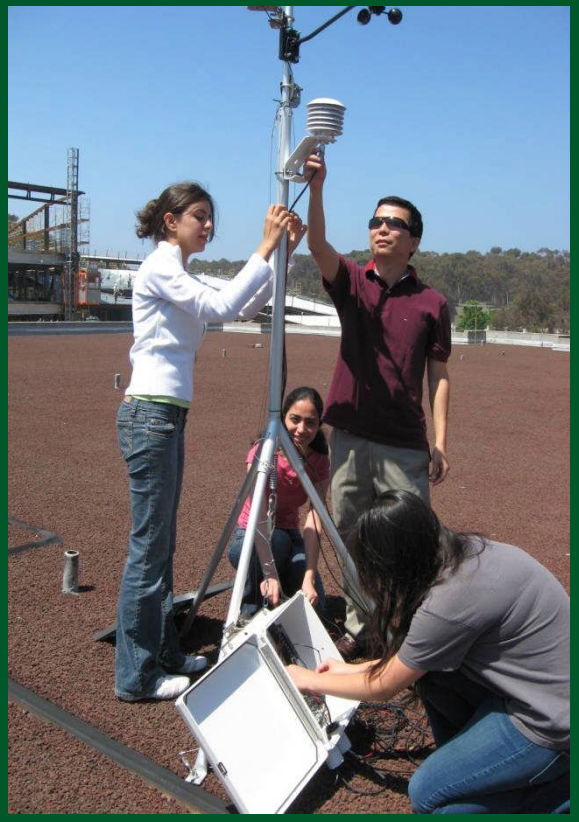
UCSD Projects – Smart Grid

- Integrate
  cyberinfrastructure
  monitoring
  generation
  building systems

- DEMROES monitor microclimate to adjust HVAC and irrigation in real time



Research: MAE, SDSC and CALIT2

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UCSD Projects - Greenlight

- Investigate new ways of measuring energy use of computing

- $2M grant for 1M sq ft retrofit of facilties by 2010

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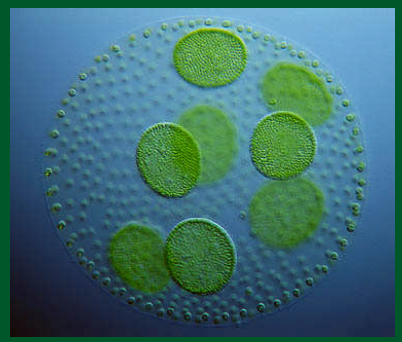
UCSD Projects - Biofuels

- Cellulose based ethanol

- Micro-algae

  Salt water, not a food



Research at SIO, Biology, MAE

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UCSD Projects – Fuel Cell

- 2.8 MW fuel cell to be installed in 2009
  - Uses waste methane from water treatment plant
  - Produces hydrogen and electricity

Research: MAE

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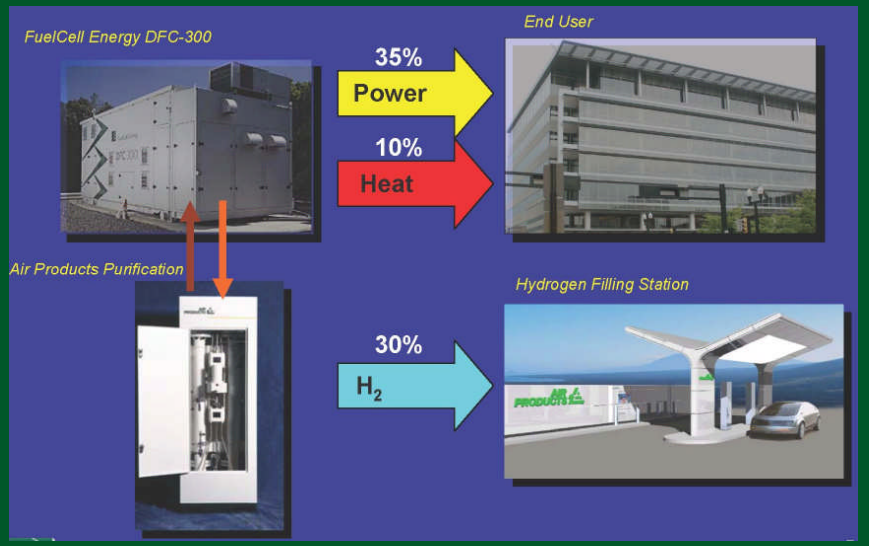
UCSD Projects – Alternative Fuel Station

- CNG and hydrogen fuel for campus fleet
- Capture waste heat from fuel cell for hythane production



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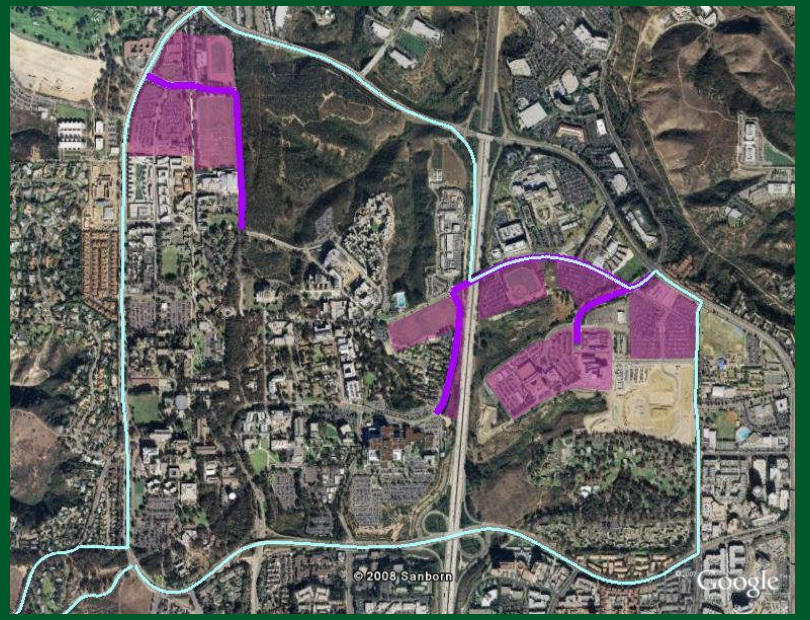
UCSD Projects – Water reuse

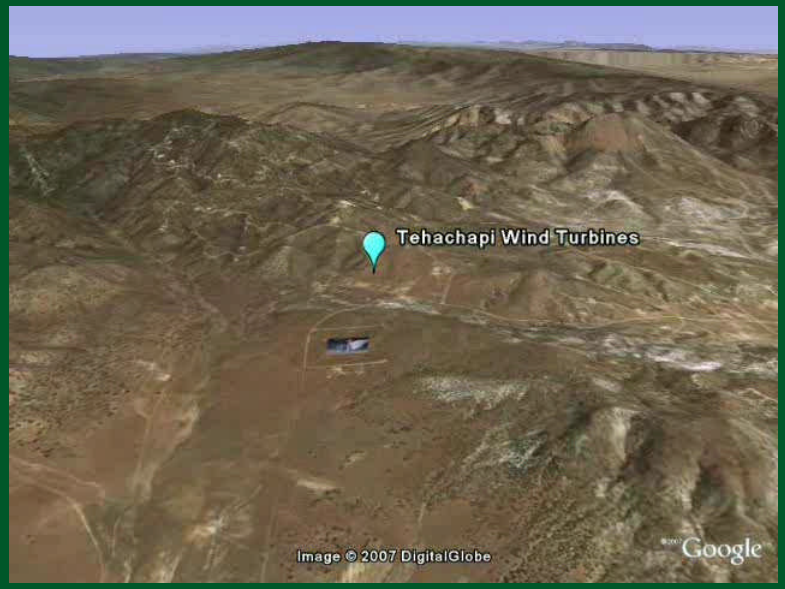
- Reclaimed water for irrigation
- Moisture monitoring



- Low flow fixtures
- Condenser water capture

UCSD Projects – Wind energy

- Off-peak wind energy
- Coordinated with cogeneration plant



Research: MAE, SE

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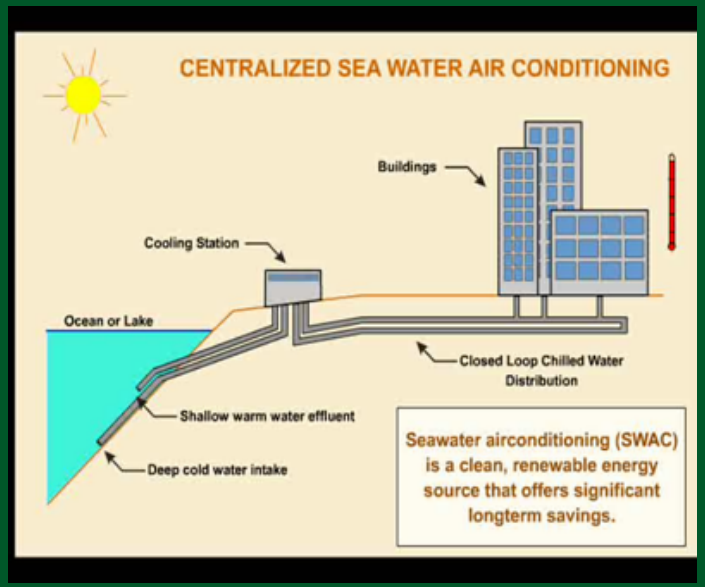
UCSD Projects – Sea water cooling

- Save annually
  - $4M in energy
  - 400M liters water



Research: SIO

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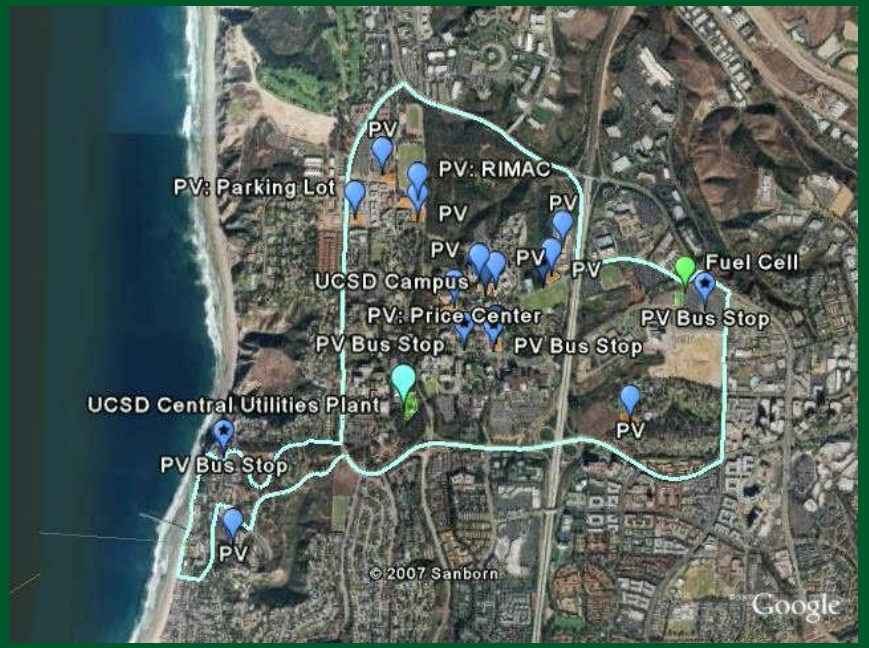
Other activities

- Chicago Climate exchange (joined 2007)
- Advance Energy Storage Initiative
- DC Grid and High Temperature Superconductor



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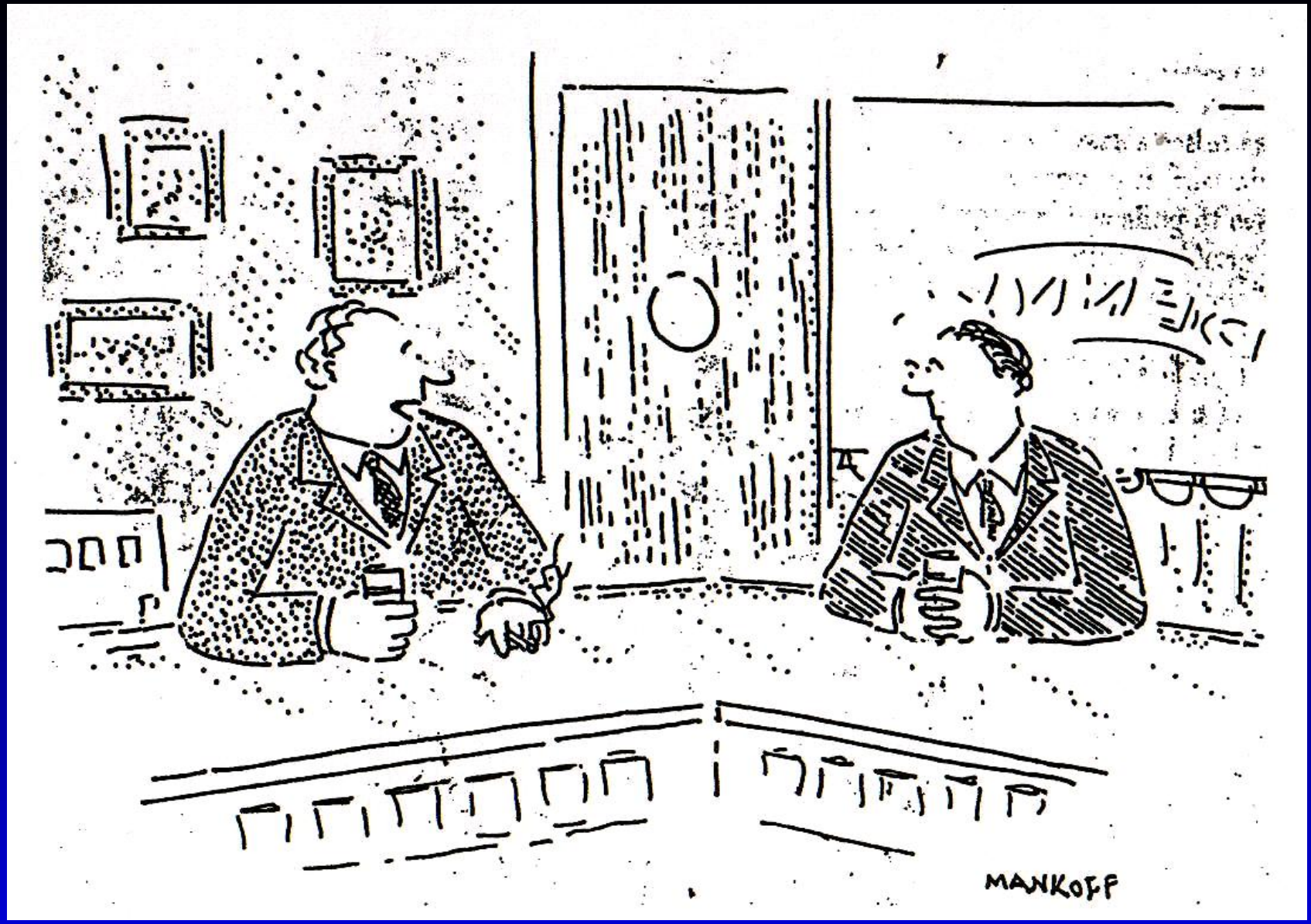

"See, the problem with doing things to prolong your life is that all the extra years come at the end, when you're old."